

**What is claimed is:**

1. A system, comprising:
  - (A) a material metering machine having a load cell, the load cell being configured to generate an analog signal, the analog signal being indicative of a load on the load cell;
  - (B) an analog-to-digital converter configured to convert the analog signal into a digital signal, the digital signal having a sampling rate of 307.2 kHz;
  - (C) a preliminary decimation element comprising:
    - (C1) a first finite-impulse-response (FIR) filter having a decimation ratio of 16, the first FIR filter being configured to reduce the sampling rate of the digital signal from 307.2 kHz to 19.2 kHz; and
    - (C2) a second FIR filter serially coupled to the first FIR filter, the second FIR filter having a decimation ratio of 16, the second FIR filter being configured to reduce the sampling rate of the digital signal from 19.2 kHz to 1200 Hz;
  - (D) a primary decimation element serially coupled to the preliminary decimation element, the primary decimation element comprising:
    - (D1) a third FIR filter having a decimation ratio of 2, the third FIR filter being configured to reduce the sampling rate of the digital signal from 1200 Hz to 600 Hz;
    - (D2) a fourth FIR filter having a decimation ratio of 10, the fourth FIR filter being configured to reduce the sampling rate of the digital signal from 600 Hz to 60 Hz; and
    - (D3) a fifth FIR filter having a decimation ratio of 6, the fifth FIR filter being configured to reduce the sampling rate of the digital signal from 60 Hz to 10 Hz; and

- 24 (E) a filter bank serially coupled to the primary decimation element, the filter bank  
 25 comprising:
- 26 (E1) selectable filters, each filter being configured to reduce the noise, the  
 27 selectable filters including a filter having a sub-hertz 3-dB cutoff frequency,  
 28 the selectable filters comprising a filter selected from the group consisting of:
- 29 (E1a) a SINC filter; and  
 30 (E1b) a raised cosine filter; and
- 31 (E2) a selectable filter switch configured to select a selectable filter, the selectable  
 32 filter being selected as a function of operating criteria, the operating criteria  
 33 being associated with the material metering machine, the operating criteria  
 34 being determined through a closed feedback loop

- 1 2. A system, comprising:  
 2 a material metering machine comprising a decimation element; and  
 3 a filter bank, the filter bank comprising:  
 4 an input node adapted to receive a signal from the decimation element, the  
 5 signal having noise from the material metering machine;  
 6 selectable filters, each selectable filter having a sub-hertz 3-dB cutoff  
 7 frequency, each filter being configured to reduce the noise.

- 1 3. A system, comprising:  
 2 a filter bank input node adapted to receive a signal having noise; and  
 3 selectable filters, each filter being configured to reduce the noise, the selectable filters  
 4 including a filter having a sub-hertz 3-dB cutoff frequency.

1           4.       The system of claim 3, wherein the selectable filters include a SINC filter.

1           5.       The system of claim 4, wherein the SINC filter has a cutoff frequency, the  
2 cutoff frequency being selected from a group consisting of:

3           approximately 0.10 Hz;

4           approximately 0.12 Hz;

5           approximately 0.15 Hz;

6           approximately 0.20 Hz;

7           approximately 0.25 Hz;

8           approximately 0.32 Hz;

9           approximately 0.40 Hz;

10          approximately 0.50 Hz; and

11          approximately 0.70 Hz.

1           6.       The system of claim 3, wherein the selectable filters include a raised cosine  
2 filter.

1           7.       The system of claim 6, wherein the raised cosine filter has a cutoff frequency,  
2 the cutoff frequency being selected from a group consisting of:

3           approximately 0.20 Hz;

4           approximately 0.30 Hz; and

5           approximately 0.40 Hz.

1           8.       The system of claim 3, further comprising:  
2 a material metering machine that contributes to the noise in the signal.

1           9.       The system of claim 8, wherein the material metering machine is adapted to  
2   measure a flow rate of material.

1           10.      The system of claim 8, wherein the material metering machine is adapted to  
2   measure weight of material within the material metering machine.

1           11.      The system of claim 8, further comprising a selectable filter switch configured  
2   to select a selectable filter, the selectable filter being selected as a function of operating  
3   criteria, the operating criteria being associated with the material metering machine, the  
4   operating criteria being determined through a closed feedback loop.

1           12.      The system of claim 3, further comprising a decimation element configured to  
2   provide the signal to the filter bank input node.

1           13.      The system of claim 3, further comprising means for providing the signal to  
2   the filter bank input node.

1           14.      A filtering method, comprising the steps of:  
2       receiving a signal having noise;  
3       selecting a filter, the filter being selected from a plurality of selectable filters, the  
4   plurality of selectable filters including a filter having a sub-hertz 3-dB cutoff frequency; and  
5       filtering the signal using the selected filter to reduce the noise.

1           15.     The method of claim 14, wherein the step of selecting the filter comprises the  
2     step of:  
3           selecting a SINC filter.

1           16.     The method of claim 15, wherein the step of selecting the SINC filter  
2     comprises the step of:  
3           selecting a SINC filter having a sub-hertz 3-dB cutoff frequency.

1           17.     The method of claim 14, wherein the step of selecting the filter comprises the  
2     step of:  
3           selecting a raised cosine filter.

1           18.     The method of claim 17, wherein the step of selecting the raised cosine filter  
2     comprises the step of:  
3           selecting a raised cosine filter having a sub-hertz 3-dB cutoff frequency.

1           19.     A filtering apparatus, comprising:  
2           a primary input node configured to receive a digital signal, the digital signal having an  
3     initial sampling rate, the digital signal further having line noise; and  
4           a primary decimation element having a decimation ratio, the primary decimation  
5     element further having a filter length, the primary decimation element being configured to  
6     reduce the line noise at 50 Hz, the primary decimation element further being configured to  
7     reduce the line noise at 60 Hz, the primary decimation element further being configured to  
8     reduce the initial sampling rate to a reduced sampling rate as a function of the decimation  
9     ratio.

1           20.     The apparatus of claim 19, wherein the initial sampling rate is 1200 Hz.

1           21.     The apparatus of claim 19, wherein the reduced sampling rate is 10 Hz.

1           22.     The apparatus of claim 19, wherein the primary decimation element  
2 comprises:

3           a first filter having a decimation ratio of 2;

4           a second filter serially coupled to the first filter, the second filter having a decimation  
5 ratio of 10; and

6           a third filter serially coupled to the second filter, the third filter having a decimation  
7 ratio of 6.

1           23.     The apparatus of claim 19, further comprising an analog-to-digital (A/D)  
2 converter, the A/D converter being configured to receive an analog signal, the A/D converter  
3 further being configured to convert the analog signal into the digital signal, the A/D converter  
4 further being configured to provide the digital signal to the primary input node.

1           24.     The apparatus of claim 19, further comprising a preliminary decimation  
2 element having an input, the preliminary decimation element further having an output, the  
3 output of the preliminary decimation element being communicatively coupled to the primary  
4 input node, the preliminary decimation element comprising:

5           a first filter having a decimation ratio of 16; and

6           a second filter serially coupled to the first filter, the second filter having a decimation  
7 ratio of 16.

1           25.     The apparatus of claim 24, further comprising an analog-to-digital (A/D)  
2 converter, the A/D converter being configured to receive an analog signal, the A/D converter  
3 further being configured to digitize the analog signal, the A/D converter further being  
4 configured to provide the digitized signal to the input of the preliminary decimation element.

1           26.     A filtering method, comprising the steps of:  
2           receiving a digital signal, the digital signal having an initial sampling rate, the digital  
3 signal further having line noise;  
4           filtering the line noise at 50 Hz;  
5           filtering the line noise at 60 Hz; and  
6           reducing the initial sampling rate of the digital signal to a reduced sampling rate.

1           27.     The method of claim 26, wherein the step of receiving the digital signal  
2 comprises the step of receiving a digital signal having a sampling rate of 1200 Hz.

1           28.     The method of claim 26, wherein the step of filtering the line noise at 50 Hz  
2 comprises the step of cascading the digital signal through multiple filters.

1           29.     The method of claim 26, wherein the step of filtering the line noise at 60 Hz  
2 comprises the step of cascading the digital signal through multiple filters.

1           30.     The method of claim 26, wherein the step of reducing the initial sampling rate  
2 comprises the step of cascading the digital signal through multiple filters.

1           31.     The method of claim 26, further comprising the step of cascading the digital  
2 signal through multiple filters.

1           32.     The method of claim 31, wherein the step of cascading the digital signal  
2 through multiple filters comprises the step of directing the digital signal through a filter  
3 having a decimation ratio of 16.

1           33.     The method of claim 31, wherein the step of cascading the digital signal  
2 through multiple filters comprises the step of directing the digital signal through a filter  
3 having a decimation ratio of 2.

1           34.     The method of claim 31, wherein the step of cascading the digital signal  
2 through multiple filters comprises the step of directing the digital signal through a filter  
3 having a decimation ratio of 10.

1           35.     The method of claim 31, wherein the step of cascading the digital signal  
2 through multiple filters comprises the step of directing the digital signal through a filter  
3 having a decimation ratio of 6.

1           36.     The method of claim 26, further comprising the steps of:  
2 receiving an analog data signal from a load cell, the load cell being located on a  
3 material metering machine; and  
4 converting the analog signal into the digital signal.



1           37.     The method of claim 26, wherein the step of converting the analog signal  
2 comprises the step of:  
3           generating a digital signal having a sampling rate of 1200 Hz.